Appendix 1. Unit Conversion Chart

Table 107. Metric - English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (g) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 m^3/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[2]	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 ° C = 37.4 °F

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.

[2] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix 2. Endangered, Threatened, and Sensitive Species.

Table 108. Endangered, threatened and sensitive species.

Species	Counties			
	Blaine	Camas	Gooding	Elmore
Listed Species				
Canada lynx	X	X		X
Gray wolf	X	X	X	X
Bull trout	X	X		X
Bald eagle	X		X	X
Bliss Rapids snail	X		X	X
Ute ladies'-tresses	X	X	X	X
Utah valvata snail			X	
Snake River physa snail			X	X
Banbury springs limpet				
Idaho springsnail				X
Candidate species				
Slick spot peppergrass				X
Sensitive species				
Mammals				
Yuma myotis	X			X
Long-eared myotis	X		X	
Long-legged myotis	X			
Western small-footed myotis	X			X
Townsend's big eared bat	X		X	
Pygymy rabbit	X	X	X	X
Wolverine	X	X		X
Western pipistrelle			X	
Kit fox				X
Fisher				X
Merriam's shrew				X
Fish				
Redband trout	X	X	X	X
Wood River sculpin	X	X		
Leatherside chub				
Shoshone sculpin			X	
White sturgeon				X
Birds				
Columbian sharp-tailed grouse	X			X
Greater sage-grouse	X	X	X	X
Yellow-billed cuckoo	X			X
White-faced ibis	X			
Trumpeter swan	X	X	X	
Northern goshawk	X	X		X
Ferruginous hawk	X			X
Black tern	X	X		
Long billed curlew	X	X	X	X

Species	Counties			
	Blaine	Camas	Gooding	Elmore
Flammulated owl	X	X		X
Boreal owl	X			
Three-toed woodpecker	X			
Western burrowing owl				X
Mountain quail				X
White-headed woodpecker				X
Invertebrates				
Idaho Dunes tiger beetle	X			
California floater				
Amphibians and Reptiles				
Western toad	X	X		X
Northern leopard frog	X	X	X	X
Columbia spotted frog	X	X	X	X
Common garter snake	X	X	X	X
Short-horned lizard	X	X	X	X
Mojave black-collared lizard	X	X	X	X
Woodhouse's toad				X
Idaho giant salamander				X
Longnose snake				X
Ground snake				X
Plants				
Slender moonwart	X	X	X	X
Meadow pussytoes	X			
Mourning milkvetch	X	X	X	X
Bugleg goldenweed	X	X		X
Obscure phacelia	X			
Least phacelia		X		
Idaho douglasia				X
Davis' peppergrass				X
Lichens				
Wovenspore lichen				X

[a]Data collected from USFWS Web site (2001).

Appendix 3. State and Site-Specific Standards and Criteria

Table 109. Surface water quality criteria.

IDAPA58.01.02	Criteria
200.	**General Surface Water Quality Criteria**. The following general water quality criteria apply to all surface waters of the state, in addition to the water quality criteria set forth for specifically designated waters.
01.	**Hazardous Materials**. Surface waters of the state shall be free from hazardous materials in concentrations found to be of public health significance or to impair designated beneficial uses.
02.	**Toxic Substances**. Surface waters of the state shall be free from toxic substances in concentrations that impair designated beneficial uses.
03.	**Deleterious Materials**. Surface waters of the state shall be free from deleterious materials in concentrations that impair designated uses.
04.	**Radioactive Materials**.
a.	Radioactive materials or radioactivity shall not exceed the values listed in the Code of Federal Regulations, Title 10, Chapter 1, Part 20, Appendix B, Table 2, Effluent Concentrations, Column 2.
b.	Radioactive materials or radioactivity shall not exceed concentrations required to meet the standards set forth in Title 10, Chapter 1, Part 20 of the Code of Federal Regulations for maximum exposure of critical human organs in the case of foodstuffs harvested from these waters for human consumption.
05.	**Floating, Suspended or Submerged Matter**. Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses.
06.	**Excess Nutrients**. Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.
07.	**Oxygen-Demanding Materials**. Surface waters of the state shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition.
08.	**Sediment.** Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses.
09.	**Natural Background Conditions**. When natural background conditions exceed any applicable water quality criteria set forth in Sections 210,250, 251, 252, or 253 the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increased above natural background conditions when allowed under Section 401.
250.	**Surface Water Quality Criteria for Aquatic Life Use Designations**
01.	**General Criteria**
a.	Hydrogen Ion Concentration(pH) values within the range of 6.5 to 9.0
b.	The total concentration of dissolved gas not exceeding 110% of saturation at atmospheric pressure at the point of sample collection
c.	Total chlorine residual. One hour average concentration not to exceed 19ug/l or four day average concentration not to exceed 11ug/l
02.	**Cold Water**
a.	Dissolved Oxygen Concentrations exceeding 6 mg/l at all times. In lakes and reservoirs this standard does not always apply
b.	Water temperatures of 22 degrees C or less with a maximum daily average of no greater than 19 degrees C.

IDAPA58.01.02	Criteria
c.	Temperature in lakes shall have no measurable change from natural background conditions.
d.	Ammonia. The following criteria are not to be exceeded dependent on the temperature and pH of the water body
i.	Acute Criterion. The one hour average concentration of total ammonia nitrogen is not to exceed more than once every 3 years, the calculated CMC value
ii.	Chronic Criterion. The thirty day average concentration of total ammonia nitrogen is not to exceed, more than once every 3 years, the calculated CCC value.
d.	Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than 50NTU instantaneously or more than 25 NTU for more than 10 consecutive days.
e.	**Salmonid spawning**: waters designated for salmonid spawning are to exhibit the following characteristics during the spawning period and incubation for the particular species inhabiting those waters:
i.(1)	Dissolved Oxygen. Intergravel dissolved oxygen. One day minimum of not less than 5.0 mg/l.
i.(2)	Water-Column dissolved Oxygen. One day minimum of not less than 6.0 mg/l or 90% of saturation, whichever is greater
ii.	Water temperatures of 13 degrees C or less with a maximum daily average no greater than 9 degrees C
251.	**Surface water quality criteria for recreation use designations**
01.	**Primary Contact recreation**. Waters designated for primary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding
b.	For all other waters designated for primary contact recreation, a single sample of four hundred six *E. coli* organisms per 100ml or
c.	A geometric mean of 126 *E. coli* organisms per 100ml based on a minimum of 5 samples taken every 3 to 5 days over a 30 day period.
02.	**Secondary Contact recreation**. Waters designated for secondary contact recreation are not to contain *E. coli* bacteria significant to the public health in concentrations exceeding:
a.	A single sample of 576 *E. coli* organisms per 100ml or
b.	A geometric mean of 126 *E. coli* organisms per 100 ml based on a minimum of 5 samples taken every 3 to 5 days over a 30day period.
252.	**Surface Water Quality Criteria for Water Supply Use Designation**
02.	**Agricultural.** Water quality criteria for agricultural water supplies will generally be satisfied by the water quality criteria set for in Section 200.
03.	**Industrial**. Water quality criteria for industrial water supplies will generally be satisfied by the general water quality criteria set forth in Section 200.
253.	**Surface Water Quality Criteria for Wildlife and Aesthetic Use Designations**
01.	**Wildlife Habitats**. Water quality criteria for wildlife habitats will generally be satisfied by the general water quality criteria set forth in Section 200.
02.	**Aesthetics**. Water quality criteria for aesthetics will generally be satisfied by the general water quality criteria set forth in Section 200.
401.03	**Treatment Requirements**. Unless more stringent limitations are necessary to meet the applicable requirements of Sections 200 through 300 or unless specific exemptions are made pursuant to Subsection 080.02 or 401.05, wastewaters discharged into surface waters of the state must have the following characteristics:
a.	Temperature-the wastewater must not affect the receiving water outside the mixing zone so that
i.	The temperature of the receiving water or of downstream waters will interfere with designated beneficial uses

IDAPA58.01.02	Criteria
ii.	Daily and seasonal temperature cycles characteristic of the water body are not maintained
iii.	If the water is designated for warm water aquatic life, the induced variation is more than plus two (+2) degrees C
iv.	If the water is designated for cold water aquatic life, seasonal cold water aquatic life, or salmonid spawning, the induced variation is more than plus one (+1) degree C.
v.	If temperature criteria for the designated aquatic life use are exceeded in the receiving waters upstream of the discharge due to natural background conditions, then Subsections 401.03.a.iii. and 401.03.a.iv. do not apply and instead wastewater must not raise the receiving water temperatures by more than three tenths (0.3) degrees C.

[a]Criteria copied from Water Quality Standards and Wastewater Treatment Requirements.

Appendix 4. Stream bank erosion inventory segments.

This appendix includes the segment breaks for the stream bank erosion inventories completed for each creek that has had a sediment TMDL completed and the methodology for the NRCS Stream Bank Erosion Inventory Process.

Table 110 identifies the segment breaks for each segment of the creeks that have had sediment TMDLs completed

Table 110. Stream bank erosion segmentation identification.

Creek	Segment	Upper GPS point			Lower GPS point		
		deg	min	sec	deg	min	sec
Beaver	Upper (headwater to 1.6 miles upstream of mouth)	43	29	26	43	26	49
		114	31	10	114	33	36
	Lower (1.6 miles upstream of mouth to mouth)	43	26	49	43	26	44
		114	33	36	114	35	25
Little Beaver	Upper (headwater to 1.4 miles upstream of mouth)	43	29	25	43	27	32
		114	32	24	114	33	31
	Lower (1.4 miles upstream of mouth to mouth)	43	27	32	43	26	51
		114	33	31	114	34	41
Willow	Upper (headwaters to Cherry Creek)	43	34	13	43	27	53
		114	37	22	114	37	00
	Middle (Cherry Creek to Severe Creek)	43	27	53	43	24	13
		114	37	00	114	34	21
	Lower (Severe Creek to mouth)	43	24	13	43	20	04
		114	34	21	114	32	42
Camp	Upper (headwaters to road crossing 2.3 miles upstream of Eagle Creek)	43	28	31	43	26	4
		114	30	19	114	29	44
	Lower upper (road crossing 2.3 miles upstream of Eagle Creek to 1.1 miles upstream of Eagle Creek)	43	26	4	43	25	4
		114	29	44	114	29	56
	Upper middle (1.1 miles upstream of Eagle Creek to 0.8 miles downstream of Spare Creek)	43	25	4	43	21	52
		114	29	56	114	31	21
	Lower middle (0.8 miles downstream of Spare Creek to spring confluence above highway)	43	21	52	43	20	44
		114	31	21	114	29	01
	Lower (spring confluence above highway to mouth)	43	20	44	43	19	52
		114	29	01	114	28	35
Elk	Upper (headwaters to 4.3 miles upstream of mouth)	43	28	22	43	23	45
		114	40	45	114	37	58
	Lower (4.3 miles upstream of mouth to mouth)	43	23	45	43	20	20
		114	37	58	114	37	57
Soldier	Upper (Forks to Sampson Creek)	43	29	52	43	25	43

Creek	Segment	Upper GPS point			Lower GPS point		
		deg	min	sec	deg	min	sec
		114	49	58	114	48	06
	Middle (Sampson Creek to highway 20)	43	25	43	43	20	33
		114	48	06	114	47	13
	Lower (highway 20 to mouth)	43	20	33	43	17	31
		114	47	13	114	45	10
Corral	Upper (Forks to highway 20)	43	24	01	43	20	33
		114	55	59	114	55	31
	Lower (highway 20 to mouth)	43	20	33	43	17	36
		114	55	31	114	54	14
Cow	Upper (headwaters to 2.1 miles upstream of reservoir)	43	22	39	43	22	15
		115	7	41	115	07	08
	Middle (2.1 miles upstream of reservoir to 0.9 miles upstream of reservoir)	43	22	15	43	21	30
		115	07	08	115	06	23
	Lower (0.9 miles upstream of reservoir to reservoir)	43	21	30	43	20	49
		115	06	23	115	05	51
Wild Horse	Upper (headwaters to creek confluence 5 miles upstream of mouth)	43	19	11	43	20	03
		115	13	25	115	10	06
	Middle (creek confluence 5 miles upstream of mouth to highway 20)	43	20	03	43	18	34
		115	10	06	115	08	33
	Lower (highway 20 to mouth)	43	18	34	43	16	49
		115	08	33	115	08	18
Camas	Upper (headwaters to spring complex)	43	16	54	43	16	05
		115	20	02	115	15	59
	Lower upper (spring complex to Hall Gulch Creek confluence)	43	16	05	43	16	32
		115	15	59	115	06	24
	Upper middle (Hall Gulch Creek confluence to road crossing on Wolf Lane)	43	16	32	43	17	53
		115	06	24	114	58	03
	Lower middle (road crossing on Wolf Lane to Soldier Creek)	43	17	53	43	17	31
		114	58	03	114	45	11
	Upper lower (Soldier Creek to 2.2 miles upstream of Willow Creek)	43	17	31	43	19	58
		114	45	11	114	34	42
	Lower (2.2 miles upstream of Willow Creek to reservoir)	43	19	58	43	19	32
		114	34	42	114	27	31
Dairy	Upper (headwaters to road crossing 3.7 miles upstream of reservoir)	43	15	30	43	15	23
		114	56	53	114	54	36
	Lower (road crossing 3.7 miles upstream of reservoir to reservoir)	43	15	23	43	15	40
		114	54	36	114	50	38
McKinney	Upper (Headwater to spring confluence)	43	14	39	43	12	52
		114	44	02	114	42	38
	Lower upper (spring confluence to 0.9 miles downstream of spring confluence)	43	12	52	43	12	10
		114	42	38	114	42	48
	Upper middle (0.9 miles downstream of	43	12	10	43	12	28

Creek	Segment	Upper GPS point			Lower GPS point		
		deg	min	sec	deg	min	sec
	spring confluence to 2.1 miles downstream of spring confluence)	114	42	48	114	44	04
	Lower middle (2.1 miles downstream of spring confluence to road crossing at Fir Grove Ranch)	43	12	28	43	12	34
		114	44	04	114	45	10
	Upper lower (road crossing at Fir Grove Ranch to road crossing 2.1 miles upstream of reservoir)	43	12	34	43	13	05
		114	45	10	114	47	12
	Lower (road crossing 2.1 miles upstream of reservoir to reservoir)	43	13	05	43	14	21
		114	47	12	114	49	07

The following information has been provided by Melissa Thompson (DEQ) in 2005 and describes the methodology of the NRCS Stream Bank Erosion Inventory Process.

The stream bank erosion inventory was used to estimate background and existing stream bank erosion following methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (NRCS, 1983). Using the direct volume method, sub-sections of 1998 §303(d) watersheds were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

Stream bank Erosion Inventory

The NRCS Stream bank Erosion Inventory is a field based methodology, which measures stream bank/channel stability, length of active eroding banks, and bank geometry (Stevenson, 1994). The stream bank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of stream bank characteristics that are assigned a categorical rating ranging from 0 to 3. The categories of rating the factors and rating scores are:

Bank Stability:
- Do not appear to be eroding - 0
- Erosion evident - 1
- Erosion and cracking present - 2
- Slumps and clumps sloughing off - 3

Bank Condition:
- Some bare bank, few rills, no vegetative overhang - 0
- Predominantly bare, some rills, moderate vegetative overhang - 1
- Bare, rills, severe vegetative overhang, exposed roots - 2
- Bare, rills and gullies, severe vegetative overhang, falling trees - 3

Vegetation / Cover On Banks:
- Predominantly perennials or rock-covered - 0
- Annuals / perennials mixed or about 40% bare - 1
- Annuals or about 70% bare - 2
- Predominantly bare – 3

Bank / Channel Shape:

V - Shaped channel, sloped banks - 0
Steep V - Shaped channel, near vertical banks - 1
Vertical Banks, U - Shaped channel - 2
U - Shaped channel, undercut banks, meandering channel - 3

Channel Bottom:

Channel in bedrock / noneroding - 0
Soil bottom, gravels or cobbles, minor erosion - 1
Silt bottom, evidence of active downcutting - 2

Deposition:

No evidence of recent deposition - 1
Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4) Moderate (5-8) Severe (9+)

From the Cumulative Rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year	**Slight**
0.06 - 0.15 feet per year	**Moderate**
0.16 - 0.3 feet per year	**Severe**
0.5+ feet per year	**Very Severe**

Stream bank stability can also be characterized through the following definition and the corresponding stream bank erosion condition rating from Bank Stability or Bank Condition above are included in italics.

Stream banks are considered stable if they do not show indications of any of the following features:

- **Breakdown** - Obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*
- **Slumping or False Bank** - Bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*
- **Fracture** - A crack is visibly obvious on the bank indicating that the block of bank I about to slump or move into the stream. *Bank Stability Rating 2*
- **Vertical and Eroding** - The bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Stream banks are considered covered if they show any of the following features:

- Perennial vegetation ground cover is greater than 50%. *Vegetation/Cover Rating 0*
- Roots of vegetation cover more than 50% of the bank (deep rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
- At least 50% of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*
- At least 50% of the bank surfaces are protected by logs of 4 inch diameter or larger. *Vegetation/Cover Rating 1*

Stream bank stability is estimated using a simplified modification of Platts, Megahan, and Minshall (1983, p. 13) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton, 1993). The modification allows for measuring stream bank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

- **Mostly covered and stable (non-erosional).** Stream banks are Over 50% Covered as defined above. Stream banks are Stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*
- **Mostly covered and unstable (vulnerable).** Stream banks are Over 50% Covered as defined above. Stream banks are Unstable as defined above. Such banks are typical of “false banks” observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and stable (vulnerable).** Stream banks are less than 50% Covered as defined above. Stream banks are Stable as defined above. Uncovered, stable banks are typical of stream banks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
- **Mostly uncovered and unstable (erosional).** Stream banks are less than 50% Covered as defined above. They are also Unstable as defined above. These are bare eroding stream banks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Stream banks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to be used for TMDL development.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Stream bank erosion tends to increase as a function of watershed area (NRCS, 1983). As a result, the lower stream segments of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches (Rosgen B and C channel types) (Rosgen,1996).

Because it is often unrealistic to survey every stream segment, sampled reaches were used and bank erosion rates are extrapolated over a larger stream segment. The length of the sampled reach is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and

consistent geometry need less. Typically between 10 and 30 percent of stream bank needs to be inventoried. Often, the location of some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private land owners are sometimes unwilling to allow access to stream segments within their property.
Stream reaches are subdivided into *sites* with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. Subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Stream bank erosion or channel stability inventory field methods were originally developed by the USDA USFS (Pfankuch, 1975). Further development of channel stability inventory methods are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods were made and are documented.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rate determined in the survey (NRCS, 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor.

The direct volume method is summarized in the following equations:

$$E = [A_E * R_{LR} * \ {}_B]/2000 \text{ (lbs/ton)}$$

where:
E = bank erosion over sampled stream reach (tons/yr/sample reach)
A_E = eroding area (ft^2)
R_{LR} = lateral recession rate (ft/yr)
${}_B$ = bulk density of bank material (lps/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:
E_R = bank erosion rate (tons/mile/year)
E = bank erosion over sampled stream reach (tons/yr/sample reach)
L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge

(Leopold et al, 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value should be considered a long term average. For example, a 50 year flood event might cause five feet of bank erosion in one year and over a ten year period this events accounts for the majority of bank erosion. These factors have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding. For example, the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS, 1983). Several techniques are available to quantify bank erosion rates: for example, aerial photo interpretation, anecdotal data, bank pins, and channel cross-sections.

To facilitate consistent data collection, the NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates.

The *bulk density* (ρ_B) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, or soil samples can be collected and soil bulk density measured in the laboratory.

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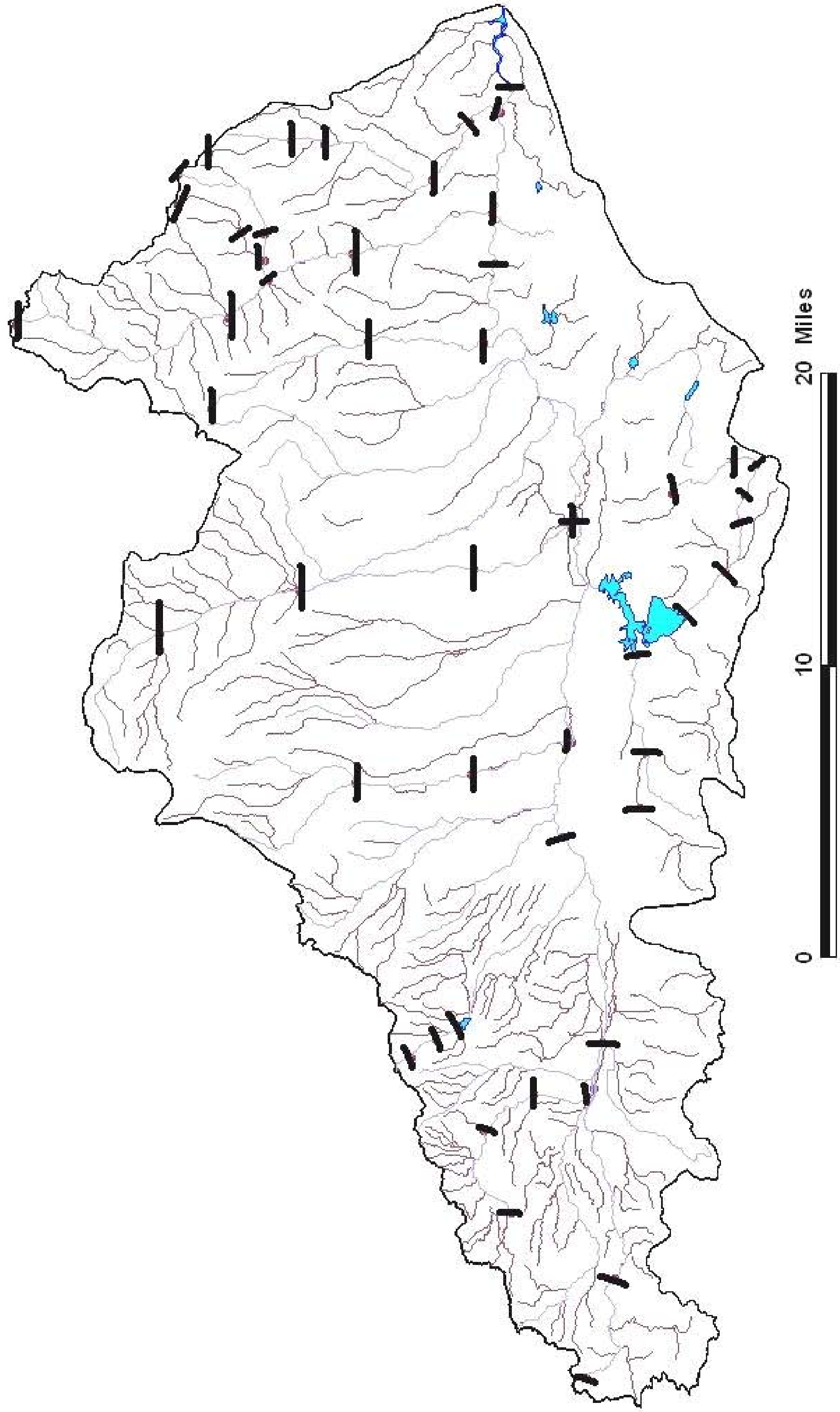

Figure 51. Camas Creek Subbasin stream bank erosion segmentation.

Appendix 5. Canopy Cover Estimates and Targets

This appendix includes the segment breaks for the canopy cover targets and existing loads, solar path finder field data comparisons to aerial photo interpretations, and the methodology for the aerial photo interpretation.

Table 111 identifies the segment breaks and existing and potential load for each segment of the creeks that have had temperature TMDLs completed. ArcView maps of the creeks showing existing canopy cover and canopy cover targets can be obtained at the DEQ Twin Falls office.

Table 111. Canopy cover estimates and targets.

Creek	Segment	Segment Length	Existing Shade	Existing Summer Load	Target or Potential Shade	Potential Summer Load	Existing load minus potential load
Camp Creek	Upper (headwaters to main road crossing 0.5 miles upstream of Eagle Creek)	1.7	0.6	11,066.2	0.75	6,916.3	4,149.81
		0.6	0.5	4,882.1	0.75	2,441.1	2,441.06
	Upper Middle (main road crossing 0.5 miles upstream of Eagle Creek to Spare Creek)	1.2	0.3	45,711.4	0.35	42,446.3	3,265.10
		0.3	0.2	13,060.4	0.35	10,611.6	2,448.83
		0.4	0.3	15,237.1	0.35	14,148.8	1,088.37
		0.2	0.2	8,712.7	0.35	7,079.1	1,633.64
		1.3	0.4	42,474.5	0.35	46,014.1	0.00
		0.5	0.3	19,059.1	0.35	17,697.7	1,361.36
		0.4	0.1	19,603.6	0.35	14,158.2	5,445.45
		0.7	0.3	26,682.7	0.35	24,776.8	1,905.91
		0.4	0.2	17,425.4	0.35	14,158.2	3,267.27
	Lower Middle (Spare Creek to spring confluence)	0.8	0.4	12,768.6	0.65	7,448.4	5,320.27
		0.4	0.3	7,448.4	0.65	3,724.2	3,724.19
		0.5	0.1	11,970.6	0.65	4,655.2	7,315.37
		0.9	0.3	16,758.8	0.65	8,379.4	8,379.42
		0.2	0.1	4,788.2	0.65	1,862.1	2,926.15
		0.3	0.3	5,586.3	0.65	2,793.1	2,793.14
	Lower (spring confluence to mouth)	0.4	0.5	7,803.4	0.5	7,803.4	0.00
		0.3	0.3	8,280.8	0.5	5,914.9	2,365.95
		0.4	0.2	12,618.4	0.5	7,886.5	4,731.91
		0.3	0.3	8,280.8	0.5	5,914.9	2,365.95
Willow Creek	Upper (headwaters to Wine Creek)	1.6	0.6	38,856.7	0.55	43,713.8	0.00
		0.5	0.5	15,178.4	0.55	13,660.6	1,517.84
		0.5	0.4	18,214.1	0.55	13,660.6	4,553.52
		0.3	0.2	14,571.3	0.55	8,196.3	6,374.93
	Middle (Wine Creek to braid 1.6 miles upstream of mouth)	1	0.4	49,284.6	0.35	53,391.6	-4,107.05
		1.2	0.3	68,998.4	0.35	64,069.9	4,928.46
		0.6	0.4	29,518.1	0.35	31,977.9	0.00

Creek	Segment	Segment Length	Existing Shade	Existing Summer Load	Target or Potential Shade	Potential Summer Load	Existing load minus potential load
		2.4	0.45	108,233.0	0.35	127,911.7	0.00
		0.2	0.3	11,479.3	0.35	10,659.3	819.95
		0.4	0.4	19,678.7	0.35	21,318.6	0.00
		0.4	0.5	16,398.9	0.35	21,318.6	0.00
		0.4	0.4	19,678.7	0.35	21,318.6	0.00
	Lower (braid 1.6 miles upstream of mouth to mouth)	0.3	0.3	11,427.9	0.5	8,162.8	3,265.10
		0.5	0.2	21,767.3	0.5	13,604.6	8,162.75
		0.4	0.1	19,590.6	0.5	10,883.7	8,706.94
		0.6	0.4	19,590.6	0.5	16,325.5	0.00
		0.4	0.2	17,413.9	0.5	10,883.7	6,530.20
		0.3	0.3	11,369.7	0.5	8,121.2	3,248.49
		0.4	0.4	12,994.0	0.5	10,828.3	2,165.66
		0.4	0.5	10,828.3	0.5	10,828.3	0.00
Beaver Creek	Upper (headwaters to 1.7 miles upstream of mouth)	1	0.6	9,388.7	0.85	3,520.8	5,867.9
		0.7	0.5	8,215.1	0.85	2,464.5	5,750.6
		0.3	0.4	4,224.9	0.85	1,056.2	3,168.7
		0.4	0.5	4,694.4	0.85	1,408.3	3,286.0
		0.5	0.4	7,041.5	0.85	1,760.4	5,281.1
		0.4	0.3	6,572.1	0.85	1,408.3	5,163.8
		0.6	0.5	7,041.5	0.85	2,112.5	4,929.1
	Lower (1.7 miles upstream of mouth to mouth)	0.5	0.4	8,919.3	0.6	5,946.2	2,973.1
		0.9	0.5	13,378.9	0.6	10,703.1	2,675.8
		0.3	0.4	5,351.6	0.6	3,567.7	1,783.9
Little Beaver Creek	Upper (headwaters to tributary 1.5 miles upstream of mouth)	0.7	0.2	7,360.7	0.85	1,380.1	5,980.6
		0.2	0.5	1,314.4	0.85	394.3	920.1
		0.4	0.3	3,680.4	0.85	788.7	2,891.7
		0.2	0.5	1,314.4	0.85	394.3	920.1
		0.4	0.3	3,680.4	0.85	788.7	2,891.7
		0.8	0.45	5,783.4	0.85	1,577.3	4,206.1
		0.5	0.4	3,943.3	0.85	985.8	2,957.4
	Lower (tributary 1.5 miles upstream of mouth to mouth)	0.3	0.3	3,220.3	0.75	1,150.1	2,070.2
		0.3	0.5	2,300.2	0.75	1,150.1	1,150.1
Soldier Creek	Upper (headwaters to road crossing upstream of baseline road)	0.2	0.4	8,487.4	0.55	6,365.5	2,121.8
		2.2	0.6	62,240.9	0.55	70,021.0	0.0
		1.7	0.55	54,107.1	0.55	54,107.1	0.0
		0.5	0.4	21,218.5	0.55	15,913.9	5,304.6
		1.4	0.3	69,313.7	0.55	44,558.8	24,754.9
		1.3	0.4	55,168.0	0.55	41,376.0	13,792.0
	Lower (road crossing upstream of baseline road to mouth)	1	0.1	78,583.5	0.3	61,120.5	17,463.0
		0.2	0.2	13,970.4	0.3	12,224.1	1,746.3
		0.7	0.3	42,784.3	0.3	42,784.3	0.0
		0.5	0.2	34,926.0	0.3	30,560.2	4,365.7

Creek	Segment	Segment Length	Existing Shade	Existing Summer Load	Target or Potential Shade	Potential Summer Load	Existing load minus potential load
		0.9	0.1	70,725.1	0.3	55,008.4	15,716.7
		1.5	0.2	104,778.0	0.3	91,680.7	13,097.2
		0.3	0.1	23,575.0	0.3	18,336.1	5,238.9
		2.6	0	227,018.9	0.3	158,913.3	68,105.7
Corral Creek	Main stem (Forks to mouth)	0.7	0.2	28,216.2	0.50	17,635.1	10,581.1
		0.2	0.1	9,069.5	0.50	5,038.6	4,030.9
		1.6	0.4	48,370.6	0.50	40,308.8	8,061.8
		0.6	0.1	27,208.5	0.50	15,115.8	12,092.7
		0.2	0.3	7,054.0	0.50	5,038.6	2,015.4
		0.2	0.2	8,061.8	0.50	5,038.6	3,023.2
		1.2	0.3	42,324.3	0.50	30,231.6	12,092.7
		0.5	0.2	20,154.4	0.50	12,596.5	7,557.9
		1.1	0.1	49,882.2	0.50	27,712.3	22,169.9
		0.3	0.2	12,092.7	0.50	7,557.9	4,534.7
		1.4	0	70,540.5	0.50	35,270.2	35,270.2
Wild Horse Creek	Main stem (Forks to mouth)	2	0	73,857.8	0.50	36,928.9	36,928.9
		0.8	0.4	17,725.9	0.50	14,771.6	2,954.3
		0.2	0.2	5,908.6	0.50	3,692.9	2,215.7
		0.5	0.1	16,618.0	0.50	9,232.2	7,385.8
		0.5	0.3	12,925.1	0.50	9,232.2	3,692.9
		1.2	0.1	39,883.2	0.50	22,157.3	17,725.9
		0.5	0.2	14,771.6	0.50	9,232.2	5,539.3
		0.4	0.3	10,340.1	0.50	7,385.8	2,954.3
		0.8	0.2	23,634.5	0.50	14,771.6	8,862.9
		0.5	0.3	12,925.1	0.50	9,232.2	3,692.9
		1.2	0.2	35,451.8	0.50	22,157.3	13,294.4
		0.6	0.1	19,941.6	0.50	11,078.7	8,862.9
Camas Creek	Upper (headwaters to spring complex)	0.5	0.1	7,041.5	0.3	5,476.7	1,564.78
		0.5	0.4	4,694.4	0.3	5,476.7	0.00
		0.3	0.3	3,286.0	0.3	3,286.0	0.00
		0.5	0.4	4,694.4	0.3	5,476.7	0.00
		0.6	0.5	4,694.4	0.3	6,572.1	0.00
		0.5	0.4	4,694.4	0.3	5,476.7	0.00
		0.2	0.1	2,816.6	0.3	2,190.7	625.91
	Lower upper (spring complex to Cow Creek confluence)	0.7	0.3	46,286.4	0.3	46,286.4	0.00
		0.3	0.1	25,434.0	0.3	19,782.0	5,652.00
		0.6	0.2	45,216.0	0.3	39,564.0	5,652.00
		1.5	0.4	84,780.0	0.3	98,910.0	0.00
		0.8	0.2	60,288.0	0.3	52,752.0	7,536.00
		1.7	0.1	144,126.0	0.3	112,098.0	32,028.01
		0.3	0.3	19,782.0	0.3	1,9782.0	0.00
		0.6	0.4	33,912.0	0.3	39,564.0	0.00
		0.4	0.5	18,840.0	0.3	26,376.0	0.00

Creek	Segment	Segment Length	Existing Shade	Existing Summer Load	Target or Potential Shade	Potential Summer Load	Existing load minus potential load
		0.5	0.3	32,970.0	0.3	32,970.0	0.00
		1	0.1	84,780.0	0.3	65,940.0	18,840.01
		0.5	0.2	37,680.0	0.3	32,970.0	4,710.00
		0.8	0.4	45,216.0	0.3	52,752.0	0.00
		0.5	0.3	32,970.0	0.3	32,970.0	0.00
	Upper middle (Cow Creek confluence to Soldier Creek confluence)	0.6	0.2	76,883.9	0.18	78,806.0	-1,922.10
		8.4	0	1,343,336.2	0.18	1,101,535.7	241,800.51
		1.2	0.1	172,714.7	0.18	157,362.2	15,352.41
		0.4	0	63,968.4	0.18	52,454.1	11,514.31
	Lower middle (Soldier Creek confluence to Elk Creek confluence)	0.8	0.1	121,979.3	0.18	111,136.7	10,842.60
		0.2	0.2	27,039.5	0.18	27,715.5	0.00
		0.4	0.1	60,838.8	0.18	55,430.9	5,407.90
		0.5	0.2	67,598.7	0.18	69,288.7	0.00
		0.4	0.1	60,838.8	0.18	55,430.9	5,407.90
		0.8	0.1	121,677.6	0.18	110,861.9	10,815.79
		6	0	1,013,980.3	0.18	831,463.9	182,516.46
		0.8	0.1	121,677.6	0.18	110,861.9	10,815.79
		1	0	168,996.7	0.18	138,577.3	30,419.41
	Lower (Elk Creek confluence to mouth)	1.2	0.1	139,253.3	0.15	131,517.0	7,736.29
		1.6	0.4	123,780.7	0.15	175,356.0	0.00
		0.6	0.2	61,890.4	0.15	65,758.5	0.00
		0.2	0.3	18,051.4	0.15	21,919.5	0.00
		0.2	0.2	20,630.1	0.15	21,919.5	0.00
		0.2	0.4	15,472.6	0.15	21,919.5	0.00
		0.8	0.2	82,520.5	0.15	87,678.0	0.00
		0.4	0.1	46,417.8	0.15	43,839.0	2,578.76
		0.4	0.3	36,102.7	0.15	43,839.0	0.00
		0.3	0.2	30,945.2	0.15	32,879.3	0.00
		1	0.3	90,256.8	0.15	109,597.5	0.00
		1	0.2	103,150.6	0.15	109,597.5	0.00
		0.3	0.1	34,813.3	0.15	32,879.3	1,934.07

[a]Segment length measured in approximate miles, existing shade and target or potential shade in decimal form for percentage, Existing summer load, potential summer load, and existing load minus potential load measured in kWh/day.

Table 112 identifies the similarities between aerial photo interpretations and solar path finder field data for canopy cover.

Table 112. Aerial versus pathfinder data.

Water body	Average Annual Shade	Average Summer Shade	Aerial Photo Cover	Aerial minus Summer Average	Aerial minus Annual Average
Corral Creek	21.1	14	20	6	11
Soldier Creek	19.2	18.7	10	-8.7	1
Elk Creek	15.1	12	20	8	11
Little Beaver Creek	37.3	32.9	50	17.1	41
Beaver Creek	35.9	23.5	40	16.5	31
Willow Creek	36.6	23.4	20	-3.4	11
Camp Creek	15.0	11.1	30	18.9	21
Camas Creek	11.5	5.9	20	14.1	11
Average	24.0	17.7	26.3	8.6	17.3

[a] Pathfinder data provided by DEQ Twin Falls, Aerial Photo interpretation provided by Mark Shumar (DEQ state office).

The following information was provided by Mark Shumar (DEQ) in 2005 and describes the usage of potential natural vegetation for temperature TMDLs and the methodology for aerial photo interpretation of canopy cover.

Potential Natural Vegetation for Temperature TMDLs

There are a several important contributors of heat to a stream including ground water temperature, air temperature and direct solar radiation. Of these, direct solar radiation is the source of heat that is easiest to control or manipulate. The parameter that affects or controls the amount of solar radiation hitting a stream throughout its length is shade. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Again, the amount of shade provided by objects other than vegetation is not easy to control or manipulate. This leaves vegetation as the most likely source of change in solar radiation hitting a stream.

Depending on how much vertical elevation also surrounds the stream, vegetation further away from the riparian corridor can provide shade. However, riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. We can measure the amount of shade that a stream enjoys in a number of ways. Effective shade, that shade provided by all objects that intercept the sun as it makes its way across the sky, can be measured in a given spot with a solar pathfinder or with optical equipment similar to a fish-eye lens on a camera. Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and the stream’s aspect. In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream, and can be measured using a densiometer, or estimated visually either on site or on aerial photography. All of these methods tell us information about how much the stream is covered and how much of it is exposed to direct solar radiation.

Potential natural vegetation (PNV) along a stream is that intact riparian plant community that has grown to its fullest extent and has not been disturbed or reduced in anyway. The PNV can be removed by disturbance either naturally (wildfire, disease/old age, wind-blown, wildlife grazing) or anthropogenically (domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides the most shade and the least achievable solar loading to the stream. Anything less than PNV is allowing the stream to heat up from excess solar inputs. We can estimate PNV from models of plant community structure (shade curves for specific riparian plant communities), and we can measure existing vegetative cover or shade. Comparing the two will tell us how much excess solar load the stream is receiving, and what can be done to decrease solar gain.

Existing shade or cover will be estimated for entire lengths of streams from visual observations of aerial photos. These estimates can be field verified by measuring shade with solar pathfinders or cover with densiometers at randomly or systematically located points along the stream (see below for methodology). PNV will be determined from existing shade curves developed for similar vegetation communities. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, the shade decreases as the vegetation has less ability to shade the center of wide streams. Existing and PNV shade can be converted to solar load from data collected on flat plate collectors at the nearest weather station collecting these data. The difference between existing and potential solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards. Existing shade cannot be greater than PNV shade, thus existing loads cannot be less than PNV loads. PNV shade and loads are assumed to be the natural condition, thus stream temperatures under PNV conditions are considered to be the lowest achievable temperatures (so long as there are no point sources or any other anthropogenic sources of heat in the watershed).

Pathfinder Methodology

The solar pathfinder is a device that allows one to trace the outline of shade producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the spot that the tracing is made. In order to adequately characterize the effective shade on a stream, as many of these traces as possible should be taken at systematic or random intervals along the length of the stream in question. At a minimum, five charts should be taken to be averaged to represent shade on a stream reach.

At each sampling location the solar pathfinder should be placed in the middle of the stream about one foot above the water. Follow the manufacturer's instructions (orient to true south and level) for taking traces. Systematic sampling is easiest to accomplish and still not bias the location of sampling. Start at a unique location such as 100 m from a bridge or fence line and then proceed upstream or downstream stopping to take additional traces at fixed intervals (e.g. every 100m, every half-mile, every degree change on a GPS, every 0.5 mile change on an odometer, etc.). On can also randomly locate points of measurement by generating random numbers to be used as interval distances. The more traces the better, for example, if the stream is four miles long paralleled by a road, you could stop at every ¼ mile to take a trace resulting in a good number of traces (about 17). If you stopped at every 0.1 mile interval, you could take over 40 traces.

It is a good idea to take notes while taking solar pathfinder traces, and to photograph the stream at several unique locations. Pay special attention to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade producing ones) are present. Additionally, one can take densiometer readings at the same location as solar pathfinder traces. This provides the potential to develop relationships between canopy cover and effective shade for a given stream.

Aerial Photo Interpretation

Canopy coverage estimates are provided for 200-foot elevational intervals, or natural breaks in vegetation density, marked out on a 1:100K hydrography. Each interval is assigned a single value representing the bottom of a 10% canopy coverage class as described below (*adapted from the CWE process, IDL, 2000*):

Cover class	**Typical vegetation type**
0 = 0 – 9% cover	agricultural land, denuded areas
10 = 10 –19%	ag land, meadows, open areas, clearcuts
20 = 20 – 29%	ag land, meadows, open areas, clearcuts
30 = 30 – 39%	ag land, meadows, open areas, clearcuts
40 = 40 – 49%	shrublands/meadows
50 = 50 – 59%	shrublands/meadows, open forests
60 = 60 – 69%	shrublands/meadows, open forests
70 = 70 – 79%	forested
80 = 80 – 89%	forested
90 = 90 –100%	forested

Additionally, a code can be provided to indicate condition or type of vegetation seen at that interval. These codes are as follows:

N = natural forest or larger than a buffer area around stream
B = buffer area around stream, cut or open area with a short distance from stream
C = opening or clearcut on stream itself (stream exposed)
M = meadow/shrubland or alpine type
NA = In some cases no recognizable channel was seen on the photo even though the map shows a stream at 1:100K hydrography. In these few instances we have marked them as NA, no channel visible. Doesn’t mean that there is not something down there, we just can’t see it.

The visual estimates of cover should be field verified with either a densiometer or a solar pathfinder. The pathfinder measures effective shade and is taking into consideration other physical features that block the sun from hitting the stream surface (e.g. hillsides, canyon walls, terraces, man-made structures). The densiometer simply measures the more immediate canopy surrounding the stream. The estimate of cover made visually from an aerial photo does not take into account topography or any shading that may occur from physical features other than vegetation. However, research has shown that measurements taken by the two techniques are remarkably similar (OWEB, no date).

References

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Appendix 6. Implementation Strategies.

Camas Creek Implementation Strategies

As part of the Camas Creek Total Maximum Daily Load

Although only a segment may be listed in this document as being impaired the TMDLs incorporate the entire length of the water body.

Camas Creek (2532)

Boundary: Headwaters to Macon Flat Bridge
Primary Pollutant-of-Concern: Sediment, Nutrients, Temperature, Flow Alteration
TMDLs Completed: Sediment, Nutrients, Temperature
Delisting: Not Applicable (n.a.)
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2045	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2045	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2045	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2045	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2045	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Soldier Creek (2537)

Boundary: Baseline Road to Camas Creek
Primary Pollutant-of-Concern: Bacteria, DO, Flow Alteration, Nutrients, Sediment, Temperature
TMDLs Completed: Sediment, Temperature
Delisting: Nutrients, DO, Bacteria
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	n.a.	n.a.	n.a.
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms

BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Mormon Reservoir (2539)

Boundary: The entire reservoir
Primary Pollutant-of-Concern: Bacteria, DO, Flow Alteration, Nutrients, Sediment
TMDLs Completed: Nutrients, Sediment
Delisting: Bacteria
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2045	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2045	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	n.a.	n.a.	n.a.
BLM	2045	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2045	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Little Beaver Creek (5301)

Boundary: Headwaters to Beaver Creek
Primary Pollutant-of-Concern: Unknown, temperature
TMDLs Completed: Temperature
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	n.a.	n.a.	n.a.
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Camp Creek (5302)

Boundary: Headwaters to Camas Creek
Primary Pollutant-of-Concern: Unknown, Sediment, Temperature, Flow alteration
TMDLs Completed: Sediment and Temperature

Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	n.a.	n.a.	n.a.
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Willow Creek (5303)
Boundary: Beaver Creek to Camas Creek
Primary Pollutant-of-Concern: Unknown, Temperature
TMDLs Completed: Temperature
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Elk Creek (5304)
Boundary: Base Line Road to Camas Creek
Primary Pollutant-of-Concern: Unknown, Sediment, Flow alteration
TMDLs Completed: Sediment
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

McKinney Creek (5305)

Boundary: Headwaters to Mormon Reservoir
Primary Pollutant-of-Concern: Unknown, Sediment, Flow alteration
TMDLs Completed: Sediment
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2045	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2045	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	n.a.	n.a.	n.a.
BLM	2045	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2045	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Corral Creek (5306)

Boundary: Highway 20 to Camas Creek
Primary Pollutant-of-Concern: Unknown, Sediment, Temperature, Flow alteration
TMDLs Completed: Sediment and Temperature
Delisting: Not Applicable
TMDL Modification: Not applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys

			IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	n.a.	n.a.	n.a.
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Cow Creek (5307)

Boundary: Headwaters to Cow Creek Reservoirs
Primary Pollutant-of-Concern: Unknown, Sediment, Nutrients
TMDLs Completed: Sediment and Nutrients
Delisting: Not Applicable
TMDL Modification: Not applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Wild Horse Creek (5308)

Boundary: Highway 20 to Camas Creek
Primary Pollutant-of-Concern: Unknown, Sediment, Bacteria, Temperature, Flow alteration
TMDLs Completed: Sediment, Bacteria, Temperature
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms

BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Beaver Creek (5309)

Boundary: Headwaters to Willow Creek
Primary Pollutant-of-Concern: Unknown, Temperature
TMDLs Completed: Temperature
Delisting: Not Applicable
TMDL Modification: No Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2025	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	2025	Grazing Allotment Permit	IDL PFC Process Other IDL Mechanisms
USFS	2025	Grazing Allotment Permit	USFS PFC Process Other USFS Mechanisms
BLM	2025	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2025	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Dairy Creek – THIS STREAM WAS ADDED TO THE 303(d) LIST

Boundary: Headwaters to Mormon Reservoir
Primary Pollutant-of-Concern: Sediment, Nutrients, Flow alteration
TMDLs Completed: Sediment, Nutrients
Delisting: Not Applicable
TMDL Modification: Not Applicable
Implementation Strategies:

PARTIES	TIME FRAME	APPROACHES	MONITORING
ISCC, IASCD, Private	2045	Irrigated Cropland BMPs Grazing BMPs SCD Involvement Cleanup Project Development	I&E Public Outreach Photo-point Documentation Grazing Management IDFG Fish Surveys IDEQ Lakes/Reservoir Project
IDL	n.a.	n.a.	n.a.
USFS	n.a.	n.a.	n.a.
BLM	2045	Grazing Allotment Permit	BLM PFC Process Other BLM Mechanisms
Other Parties: IDEQ	2045	BURP Program WBAG d	IDEQ WQ Monitoring IDEQ WQ Assessment

Personnel from the various agencies involved in the interpretation of the time frame, approaches, and monitoring strategy are summarized as follows:

ISCC Personnel:	Charles Pentzer, Water Quality Resource Conservationist Joe Schwarzbach, Water Quality Resource Conservationist
IDL Personnel:	Timothy C. Duffner, Area Supervisor, South Central Area, Gooding ID
USFS Personnel:	Valdon Hancock, Hydrologist, Sawtooth National Forest, Region 4, Twin Falls Field Office
BLM Personnel: Field	Doug Barnum, Supervisory Natural Resource Specialist, Shoshone Office
IDFG Personnel:	n.a.
IDEQ Personnel:	Jennifer Claire, Senior Water Quality Analyst Dr. Balthasar B. Buhidar, Regional Manager – WQ Protection Mike Etcheverry, Senior Water Quality Analyst

Appendix 7. Data Sources

Table 113. Data sources for Camas Creek Subbasin assessment.

Water body	Data Source	Type of Data	When Collected
BURP data-Habitat (H), Macroinvertebrate (M), Fish (F)			
Soldier Creek	BURP files, DEQ Twin falls	H, M, F	1993, 1995
Willow Creek	BURP files, DEQ Twin falls	H, M, F	1993, 1995, 2001
Beaver Creek	BURP files, DEQ Twin falls	H, M, F	1993, 1995, 1997, 2001
Little Beaver Creek	BURP files, DEQ Twin falls	H, M, F	1993, 1995, 1997, 2001
Camp Creek	BURP files, DEQ Twin falls	H, M, F	1996, 2001
Elk Creek	BURP files, DEQ Twin falls	H, M	1993
Corral Creek	BURP files, DEQ Twin falls	H, M, F	1993
Cow Creek	BURP files, DEQ Twin falls	H, M	1993, 1996
Wild Horse Creek	BURP files, DEQ Twin falls	H, M	1993, 1996
McKinney Creek	BURP files, DEQ Twin falls	H, M	1993
Camas Creek	BURP files, DEQ Twin falls	H, M, F	1993, 1995, 2001
Fish data			
Soldier Creek	Twin falls files (USFS)	fish	2002
Willow Creek	Twin falls files (USFS, BLM, DEQ, IDFG)	fish	1990, 1992, 1993, 1994, 2000, 2001, 2002
Beaver Creek	Twin falls files (IDFG, BLM)	fish	1995, 1998
Little Beaver Creek	Twin falls files (IDFG)	fish	1998
Camas Creek	Twin falls files (DEQ, BLM)	fish	1993, 2000, 2002
Flow data			
Soldier Creek	Twin falls files (DEQ), USGS Web site	flow	1973-1978, 1992-1993, 2001-2003
Willow Creek	Twin falls files (DEQ), USGS Web site	flow	1977, 1992-1993, 2001-2003
Beaver Creek	Twin falls files (DEQ)	flow	2001-2003
Little Beaver Creek	Twin falls (DEQ)	flow	2001-2003
Camp Creek	Twin falls files (DEQ), USGS Web site	flow	1977, 2001-2003
Elk Creek	Twin falls files (DEQ), USGS Web site	flow	1977, 1992-1993, 2001-2003
Corral Creek	Twin falls files (DEQ)	flow	1992-1993, 2001-2003
Cow Creek	Twin falls files (DEQ), USGS Web site	flow	1977, 2001-2003
Wild Horse Creek	Twin falls files (DEQ),	flow	2001-2004
McKinney Creek	Twin falls files (DEQ), USGS Web site	flow	1977, 2001-2003
Camas Creek	Twin falls files (DEQ), USGS Web site	flow	1912-2003
Stream bank inventories (sbi), canopy cover (cc) , Wolman pebble counts (wp)			
Soldier Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Willow Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Beaver Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Little Beaver Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Camp Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Elk Creek	Twin falls files (DEQ)	sbi, wp	2001-2003
Corral Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Cow Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
Wild Horse Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003
McKinney Creek	Twin falls files (DEQ)	sbi, wp	2001-2003
Camas Creek	Twin falls files (DEQ)	sbi,cc,wp	2001-2003

Appendix 8. Distribution List

Balthasar Buhidar. Idaho Department of Environmental Quality, Twin Falls Office.
Clyde Lay. Idaho Department of Environmental Quality, Twin Falls Office.
Sean Woodhead. Idaho Department of Environmental Quality, Twin Falls Office.
Rob Sharpnack. Idaho Department of Environmental Quality, Twin Falls Office.
Mike Etcheverry. Idaho Department of Environmental Quality, Twin Falls Office.
Marti Bridges. Idaho Department of Environmental Quality, state office (Boise).
Mike McDonald. Idaho Department of Fish and Game, Jerome Office.
Terry Blau. Idaho Department of Water Resources, Twin Falls Office.
Tim Duffner. Idaho Department of Lands, Shoshone Office.
Valdon Hancock. United States Department of Agriculture Forest Service, Twin Falls Office.
Doug Barnum. United States Bureau of Land Management, Shoshone Office.
Chuck Caranaha. Idaho Department of Transportation, Shoshone Office.
Jennifer Clawson. Idaho Association of Soil Conservation Districts, Twin Falls ID.
Chuck Pentzer. Idaho Soil Conservation Commission, Jerome ID.
Joe Schwarzbach.
Steve Thompson. Natural Resources Conservation Service, Gooding Office.
Bill Hazen. University of Idaho County Extension Services, Gooding County.
Polly Huggins. Resource Conservation and Development, Gooding ID.
Blaine County Soil Conservation District, Hailey ID.
Elmore County Soil Conservation District, Mountain Home ID.
Camas County Commissioners, Fairfield ID.
Blaine County Commissioners, Hailey ID.
Idaho Rivers United, Boise ID.
Western Watersheds Project, Hailey ID.
City of Fairfield, Fairfield ID.
Roger Blew, Upper Snake BAG Committee, Rep-at-Large, Idaho Falls ID.
Matt Woodard, Upper Snake BAG Committee, Environment East Side Soil & Water, Idaho Falls ID.
Brian Olmstead, Upper Snake BAG Committee, Irrigated Ag, Twin Falls ID.
Hunter Osborne, Upper Snake BAG Committee, Sho-Ban Tribes, Fort Hall ID.
Brad Orme, Upper Snake BAG Committee, Livestock, St Anthony, ID.
Gary Marquardt, Upper Snake BAG Committee, Non-Municipal Permittee, Buhl ID.
Don Mays, Upper Snake BAG Committee, Recreation, Gooding ID.
Chris Randolph, Upper Snake BAG Committee, Hydropower, Boise ID.
Greg Shenton, Upper Snake BAG Committee, Local Government, DuBois ID.
Dennis Facer, Upper Snake BAG Committee, Mining, DuBois ID.
Mark Toone, Wood River WAG Committee, Gooding ID.
Clint Krahn, Wood River WAG Committee, Fairfield ID.
Bob Simpson, Wood River WAG Committee, Carey ID.
Rob Struthers, Wood River WAG Committee, Bellevue ID.
Jerry Nance, Wood River WAG Committee, Dietrich ID.
Carl Rey, Wood River WAG Committee, Fairfield ID.
Lee Brown, Wood River WAG Committee, Ketchum ID.

Roger Parker, Wood River WAG Committee, Hailey ID.
Dennis Strom, Wood River WAG Committee, Hill City ID.
Daryle James, Wood River WAG Committee, Hailey ID.
Kent Scott, Wood River WAG Committee, Gooding ID.
Carol Blackburn, Wood River WAG Committee, Shoshone ID.
Lynn Harmon, Wood River WAG Committee, Shoshone ID.
Jo Lowe, Wood River WAG Committee, Idaho Conservation League, Ketchum ID.
Dennis Koyle, Wood River WAG Committee, Gooding ID.
Bill Davis, Wood River WAG Committee, Fairfield ID.
Bryan Ravenscroft, Wood River WAG Committee, Bliss ID.
Scott Boettger, Wood River WAG Committee, Ketchum ID.
Tom Pomeroy, Wood River WAG Committee, Ketchum ID.
Bob Bolte, Wood River WAG Committee, Gooding ID.
Jack Straubhar, Wood River WAG Committee, Twin Falls ID.
Martha Turvey, EPA, Seattle WA.
Leigh Woodruff, EPA, Boise ID.

Appendix 9. Public Comments

The 30 day public comment period closed on April 13, 2005 at 5:00 p.m. During this period comments were received from the Preserve the Camas Prairie ("Coalition"), the US Forest Service, and the US Environmental Protection Agency. Those comments that were editorial were incorporated into the document. The remainder of the comments is addressed in this appendix and DEQ's responses follow the comments in italics.

PRESERVE THE CAMAS PRAIRIE ("COALITION")

PCP #1. The assessment should include an analysis of and TMDLs for all potentially-impaired water bodies within the subbasin, and at the very least for Fricke Creek.

A.) As currently drafted, the scope of the assessment is not sufficiently comprehensive. This is due in part to the fact that the assessment does not discuss all water bodies in the subbasin. The assessment states that its "starting point" for determining which TMDLs will be completed is Idaho's 1998 list of 303(d) waters. From that "starting point," the assessments purpose and goal is to "ensure impairment listings are up to date and accurate." Yet the content of the assessment indicates that those impairments listings are not complete and up to date. As a result, a number of waters which warrant TMDLs are not included in the assessment.

A list of the water bodies in the subbasin that have had data collected on them will be added to the document whether they were identified as impaired or not.

B). There are twelve water bodies of the subbasin included in the 1998 303(d) list, which include Beaver Creek, Camas Creek, Camp Creek, Corral Creek, Cow Creek, Elk Creek, Little Beaver Creek, McKinney Creek, Soldier Creek, Wild Horse Creek, Willow Creek, and the Mormon Reservoir. All of these water bodies are appropriately included in the assessment. In contrast, the assessment does not address water bodies within the subbasin that were not included on the 1998 303(d) list. One such example is Fricke Creek, discussed in detail below, which is impaired and should receive TMDLs for several impacts.

Collecting data on water bodies can be very expensive and funds lately have been limited as a result water bodies that were already identified as being impaired were identified as the high priority water bodies in the subbasin and thus were the focus of the SBA-TMDL.

C). Fricke Creek is a water body that requires close evaluation since there is a strong likelihood that it is impaired in several ways. The creek flows south from the Soldier Mountains through Camas Prairie and eventually into Camas Creek. The land surrounding the creek is farmed to its edges in many portions of its length, leaving its banks largely void of canopy cover in those areas. As with other creeks in the subbasin, this lack of shade likely causes the temperature of Fricke Creeks waters to be elevated above what is natural and what can adequately support its beneficial uses. These elevated temperatures, therefore, are likely impairing the Creeks beneficial uses and violating state water quality standards.

In addition to temperature, Fricke Creek is likely impaired by sedimentation for the same reasons. Many areas along its banks have insufficient plant growth to prevent stream bank erosion and the release of sediment from surrounding lands into the water. Lastly, Fricke Creek is also likely impaired by nutrients, since this same lack of riparian buffer allows direct flows of nutrient-containing agricultural or other runoff into the creek. Thus, it is likely that Fricke Creek is impaired by temperature, sediment, and nutrients. Such waters failing to meet water quality standards are water-quality limited and must be included in the states 303(d) list of impaired waters, or at the very least be identified and analyzed in the subbasin assessment to determine proper TMDLs. If the Department has current data from the creek which indicates it is not impaired, then such relevant data should be set forth and explained in the assessment.

DEQ is to protect the beneficial uses of the water bodies. When these uses are not fully supported TMDLs are to be developed to aid in restoring the full support of the beneficial uses. The process used within the agency is to determine the beneficial uses and the support status of a water body through the collection and analysis of biological data through the Beneficial Use Reconnaissance Program. When it is determined that beneficial uses are not being met the creek is identified on the list of impaired waters. Then data is further collected to identify pollutants within the system and to develop TMDLs if appropriate. Fricke Creek at this time, has not been assessed through the BURP protocol, likely due to the lack of water during the sampling period. And records do not indicate that data has been collected on the water body through other programs or by other agencies.

Moreover, even if the Department were to determine that Fricke Creek does not, in fact, belong on the 303(d) list, the assessment should nevertheless establish TMDLs for that water body. Section 303(d)(3) of the Clean Water Act requires states to develop TMDLs for unimpaired waters within its boundaries, taking into account “seasonal variations and margins of safety.” To be sufficiently comprehensive, and to ensure that the subbasins waters are not only restored, but also maintained, the assessment should include an analysis of (1) whether the waters of Fricke Creek are impaired and thus warrant the establishment of TMDLs, and (2) whether, if the creek is not impaired, a TMDL should nevertheless be prepared for the segment pursuant to 303(d)(3).

According to IDAPA 58.01.02.054.03, Priority of TMDL Development, “The priority of TMDL development for water quality limited water bodies identified in Subsection 054.02 shall be determined by the Director in consultation with the Basin Advisory Groups as described in Sections 39-3601, et seq., Idaho Code, depending upon the severity of pollution and the uses of the water body, including those of unique ecological significance. Water bodies identified as a high priority through this process will be the first to be targeted for development of a TMDL or equivalent process.” The high priority water bodies at this time are those identified in the settlement agreement and are the 303(d) listed water bodies.

PCP #2. TMDLs should be developed for flow alteration to comply with water quality laws and adequately protect subbasin water quality.

A). Further, the assessment does not include TMDLs for all causes of impairment. In the assessment, the Department acknowledges that "flow alteration or lack of flow has been identified as a pollutant for many of the water bodies." Flow alteration or lack of flow is frequently cited in the assessment as impacting the beneficial uses of water bodies in the subbasin. The Department also frequently mentions the importance of the relationship between the groundwater and surface water in the subbasin. Groundwater use in the subbasin has been noted by both Department and by other scientists studying the region as negatively affecting the flow of streams in the subbasin, causing streams that were once perennial to now be intermittent, or to be dry in certain segments. Notwithstanding this, TMDLs have not been established for waters impaired by flow or lack of flow. The assessment reasons that TMDLs need not be completed for those causes of impairment because they are sources of "pollution" and are not "pollutants", and that only "pollutants" require the development of TMDLs.

As was stated in the document, "(Name of creek) is impaired due to a lack of flow; however, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution, a TMDL has not been established for (Name of creek) for flow."

B). First, even the Department seems to view the distinction between "pollution"- which does not need a TMDL- and a "pollutant" – which does need a TMDL as artificial. It specifically refers to flow alteration or lack of flow in the assessment as both a "pollutant" and as "pollution." Second, courts in several states have recognized that the definition of a "pollutant" in the Clean Water Act is a broad definition and have held that flow alteration falls within the Clean Water Act's definition of a "pollutant." These holdings reflect the expansive definition of "pollutant" necessary to ensure that the goals of the Clean Water Act can be met.

Flow alteration or lack of flow is "pollution," it was misidentified in the Executive Summary as being a "pollutant". This error has been corrected.

C). Idaho's statutes addressing water quality further support a functional definition of "pollutant." Section 39-3601 of the Idaho Code, for example, states that the legislatures intent in enacting its water quality laws was to ensure "that the state of Idaho fully meet the goals and requirements of the federal clean water act." In other words, not only must the assessment comply with the letter of the Clean Water Act, but also the spirit. By not including TMDLs for flow, though it specifically recognized that flow is often a significant, if not the most significant cause of a water body's impairment, the assessment does not comply with the spirit or the goals of the Clean Water Act and, therefore, is also inconsistent with the Idaho's water quality laws.

Furthermore, section 39-3611 of the Idaho Code, the section describing the TMDL process, states that the TMDL process "shall include…pollution control strategies for both point sources and nonpoint sources for reducing those sources of pollution." Thus, even if one were to concede a difference between "pollutants" and "pollution," it nevertheless appears that the Idaho legislature believed TMDLs should be created for both types of impacts to water quality.

Section 39-3601also states that "The legislature recognizing that surface water is one of the state's most valuable natural resources, has approved the adoption of water quality standards and authorized the director of the department of environmental quality in accordance with the provisions of this chapter, to implement these standards." In addition, IDAPA 58.01.02.050.01 under Administrative Policy and Apportionment of Water states "The adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure, or to interfere with water quality criteria established by mutual agreement of the participants in interstate water pollution control enforcement procedures." We do not complete TMDLs for flow, however sediment, temperature, and TP TMDLs and the resulting implementation plans will aid in restoring water quality of the creeks during low flows as well as restoring some of the natural storage of water that are lacking as a result of poor riparian zones, stream bank stability and channelization.

PCP #3. Domestic water supply is an existing beneficial use that should be identified and considered in the assessment and TMDL development process.

Identifying the beneficial uses of the water bodies in the subbasin is a significant step in determining whether waters in the subbasin are impaired. The assessment concludes that even though "domestic water supply is listed as a water use in most of the water rights that have been searched…domestic water supply is not considered an existing beneficial use for any of the water bodies that are 303(d) listed, unless designated as such." If "domestic water supply is listed as a water use" for the subbasins waters, then domestic water supply must be a beneficial use for those water bodies addressed in the report. Residents of the Camas Prairie draw their water for domestic use from ground water. Because of that interchange between surface and groundwater in the subbasin, many of the surface streams in the area should, like the groundwater, have domestic water supply listed as a beneficial use. Failing to designate the subbasins surface waters would create an impermissible gap in the state's water quality protection system and would jeopardize the state's ability to protect its vital aquifers.

Historically, in water right claims domestic water supply was used as another term for livestock water supply (IDWR 2003). Therefore, a listing on a water right of domestic water supply does not necessarily mean that the waters were used as drinking water to a group of people. In the south central region of Idaho regulated by the Twin Falls office there are no public water systems that are supplied by surface water (Staufer 2003, Chorney 2005). In addition IDAPA 58.01.02.252.01 identifies that "(Surface) waters designated for domestic water supplies are to exhibit the following characteristics: a. Radioactive materials or radioactivity not to exceed concentrations specified in Idaho Department of Environmental Quality Rules and b. Small public water supplies (Surface Water)." There is one small *public water supply that is identified in one of the counties (Elmore County) of the Camas Creek Subbasin, however the supply system is not located within the Camas Creek Subbasin.*

Influences between surface water and ground water are more likely to be seen as a result of quantity of the water rather than quality. Differing beneficial uses between the two water systems lead to different water quality standards that protect the beneficial uses differently.

PCP #4. Impaired water bodies in the subbasin should remain listed as being impaired by "unknown" pollutants given the lack of data relied upon in the study.

The assessment recommends "de-listing" certain water bodies so that they will no longer be labeled as impaired by "unknown" pollutants. Such a move would be premature in this case and should be postponed. As the assessment consistently acknowledges, the conclusions reached in that document are derived from an extremely limited and inadequate amount of data. Labeling water bodies as being impaired by "unknown" pollutants helps offset this lack of data by making it explicit that the impacts to water quality in the subbasin are still not fully known or understood. Removing "unknown" from the list and replacing it with specific pollutants establishes a misleading impression of certainty regarding the pollutants affecting the subbasins waters. It is appropriate and desirable to list streams as being impaired by certain pollutants when those pollutants have been identified; yet it is also important to ensure that the stream is not "de-listed" for unknown pollutants before the Department can adequately demonstrate the certainty of its knowledge and data regarding the causes of harm to a given water body. Due to the lack of data on this subbasin, it would currently be impossible for the Department to present enough evidence to demonstrate it has sufficient information to safely "de-list" a water body for impairment by "unknown" pollutants.

There are no water bodies in the Camas Creek Subbasin that are being delisted. However, pollutants have been identified within the subbasin. When we collect biological data we can determine if beneficial uses are impaired. If they are impaired we can not determine from the biological data what the source of pollutant is. Therefore, it becomes listed as impaired by "unknown" until data is obtained that identifies the pollutant impairing the beneficial uses. Through the subbasin assessment and TMDL we have identified the pollutants impacting the waters of the subbasin. Although the quantity of water column data is not what would be preferred due to the lack of water in the subbasin, habitat data has been collected throughout the subbasin and has aided in determining the pollutants impacting the waters of the subbasin. "Unknown" will be removed from the list for the water bodies discussed in this document.

PCP #5. TMDLs are needed for sediment and nutrients in several additional subbasin water bodies due to lack of data.

A). As discussed above, the general lack of data is very problematic with respect to making scientifically-sound and effective water quality and TMDL determinations. Even more problematic, however, is the fact that much of the limited data collected was collected between 2001 and 2003, which were recognized drought years. The assessments heavy reliance on data derived from limited flow years could only result in the assessments underestimating the load of sediments and nutrients that are released into the subbasins water bodies, making water quality and TMDL determinations (or lack thereof) based on this low estimate inaccurate and consequently inappropriate with respect to nutrients and sediments in several water bodies.

*Ideally, there would be a great deal more data collected and the data would be collected throughout many years. However, resources are not such that we are capable of collecting this type of data throughout the region let alone the state so we have to use the best available data that we have. Water chemistry data within the water bodies has been identified as a data gap within the subbasin (*2.5 Data Gaps*).*

B). The assessments discussion of sediment impairment reveals this fundamental flaw in its current analysis. The assessment acknowledges that much of the data relied upon in the assessment was collected during "drought years," between 2001 and 2003. But then the assessment continues by stating that "the critical period for sediment transport is typically…when flow is elevated due to runoff events." Thus, the assessment recognizes that use of data from flow-limited years not only does not represent average sediment levels, but that it is probably a low estimate of sediment pollution since such pollution is elevated during high flow years and events. Determinations of whether there is an excess level of sediment in the waters should be based on how much sediment is in the water in an average or normal flow year, not how much sediment is in the water in a low flow year, since it is impossible to predict or ensure that the flow in future years will be equally low. Given this relationship between flow and sedimentation, the assessment appears to have underestimated the extent of sedimentation problems in the subbasin.

In addition to water column data (TSS), habitat data (percent fines and stream bank erosion) was collected within the subbasin. Although the TSS data has not indicated impairment, the percent fines data has indicated that there is impairment and stream bank erosion inventories have indicated that in most water bodies that there is an excessive load of sediment being delivered into the system. The stream bank erosion inventories are not dependent on flow; as a result the evaluation of sediment influences within the listed water bodies in the subbasin has been covered at various levels and is complete.

C). The assessment currently recommends that nine of the twelve 303(d) listed water bodies be listed and have TMDLs prepared for sediment. Based on the above analysis, the assessment should: (1) average its underlying data with data from above-normal and normal flow years; (2) modify TMDLs (i.e. by proportionately decreasing allowed sediment pollutant) in the draft assessment recommended for those nine listed water bodies; and (3) develop sediment TMDLs for the remaining three listed water bodies: Willow Creek, Beaver Creek, and Little Beaver Creek. As noted in the assessment, both the bedload sediment data and the stream bank stability data on Willow Creek and Little Beaver Creek indicate that even during drought years sediment is impairing beneficial uses of those creeks. Yet according to the assessment, because biological data does not seem to support the conclusion that sediment transport or erosion is impacting beneficial uses of either of those creeks, the Department decided not to complete sediment TMDLs. Given, however, that the percent fines data and the stream bank erosion data are so elevated even in drought years, a TMDL should be completed for Willow Creek and Little Beaver Creek so as to prevent additional sediment transport and corresponding harm during normal flow years.

Stream bank erosion inventories were completed to determine if stream banks were an excessive source of bedload sediment. Two of the reaches on Willow Creek were near 70% while the third reach was at 80%. The target for stream bank stability is suggested to be 80%; however, that target may vary from subbasin to subbasin depending on subbasin characteristics. Biological data on Willow Creek indicates that beneficial uses are fully supported. It would appear that stream bank stabilities of 70% or greater are capable of fully supporting beneficial uses within the subbasin. Targets for stream bank stability in the subbasin could likely be set at 70%. However as the number of larger, consistently perennial water bodies that is meeting beneficial uses is limited in the subbasin; the 70% target would be hard to attribute to other watersheds with only one water body confirming the 70% target. As a result, the stream bank stability target of 80% has been retained and applied throughout the subbasin.

Sediment is narrative criteria rather than numerical criteria so we protect for beneficial uses rather than protect a numerical value. The beneficial uses are fully supported therefore sediment does not appear to be impacting them. However, temperature TMDLs have been completed on both of these water bodies and will likely result in an increase in bank stability and limit further erosion.

D). With respect to Beaver Creek, a sediment TMDL should also be completed. The assessment states that although bedload sediment appears to be impacting beneficial uses, a sediment TMDL will not be completed. The rationale for this decision is apparently that the causes of the increased sediment are historical events and insufficient flows. It is unclear just why such events are sufficient to justify a decision not to create a sediment TMDL for Beaver Creek. The Clean Water Act specifies that establishment of TMDLs should allow for margins of safety and for variations in flows. Historical events and low flows should therefore be part of the equation when TMDLs are calculated; they should not give as reasons to avoid completing TMDLs in the first place.

The reasons for not completing a sediment TMDL on Beaver Creek are that beneficial uses are fully supported and that bank stability of the two segments of the creek are both above the 80% target. Historical events and insufficient flows due to drought are only given as possibilities of why the bedload sediment within the creek has not flushed out of the system as yet. In addition, there are beaver dams (which are building up flood plains) within the lower stretches of the creek which might be preventing the sediment from moving out of the system.

E). Similar to how data derived from low-flow years might have caused the assessment to underestimate the subbasins problems with sediment, it is likely that such low flow data also caused the assessment to underestimate the subbasins problems with nutrients. The assessment noted that several of the waters such as Soldier Creek, Willow creek and Camp Creek have elevated levels of nitrogen, but did not prepare TMDLs for nitrogen because those waters were phosphorous limited. In years with normal and above-normal flows, however, increased runoff will consequently increase the phosphorous load (which has a high tendency to bind with sediments) and other nutrients from nearby farms, livestock operations, or other sources into the area's surface waters. These sources of phosphorous, especially from cattle operations, are abundant throughout the Camas Prairie and especially on land adjacent to Willow Creek, making this high-flow high-phosphorous relationship a likely scenario. The data shows that the current levels of nitrogen in the waters present conditions that would encourage and cause nuisance aquatic growth. Even in those waters where both nitrogen and phosphorous are currently at acceptable levels, the Department should ensure that these levels do not indicate the possibility of nutrient-derived problems during normal flow years. The assessment should include complete nutrient TMDLs for waters with elevated levels of nitrogen such as Soldier, Willow, and Camp Creeks; and should establish nutrient TMDLs for other waters in the subbasin if it appears that the nutrient levels could cause nuisance aquatic growth during non drought years.

The majority of Soldier Creek and Camp Creek and most of the water bodies within the subbasin have a shortage of water during the summer months during the growing period. As a result aquatic vegetation is not going to be a nuisance when there is no water in the channel to support the vegetation. As for Willow Creek, the aquatic vegetation water quality standard again is a narrative criteria set to protect beneficial uses. Beneficial uses of Willow Creek are fully supported. Again implementation plans addressing temperature and sediment TMDLs will also aid in nutrient delivery into the streams. If water is returned to the water bodies in perennial flows nutrients within the water bodies may need to be readdressed as it is currently a data gap due to lack of flow. However, nutrients would likely not be a problem because BMPs addressing temperature and sediment are also likely to aid in limiting solar radiation delivery to the stream and thus limit plant growth.

PCP #6. Due to the high degree of interaction between surface and groundwater in the subbasin, TMDLs should be completed for nitrogen in the subbasins surface waters.

Another reason why TMDLs should be completed for water bodies in the Subbasin with elevated levels of nitrogen is that groundwater in the Camas Prairie currently is contaminated with unacceptably high levels of nitrates. According to a 2002 study, twenty-four percent of wells, or twenty-nine wells, in the Camas Prairie have levels of nitrate exceeding the maximum contaminant level ("MCL") of 10 mg/L. In contrast, only three percent of sampled wells in Idaho as a whole have nitrate levels exceeding the 10mg/L standard. The Camas Prairie also ranked fifth in a 2002 list of the top twenty-five nitrate degraded areas or "nitrate priority areas" in Idaho. Only four areas in the entire state of Idaho were deemed by the Department to have more serious problems with nitrate contamination than the Camas Prairie. Contaminated groundwater is a problem because it can affect the quality of other water bodies in the subbasin (in violation of surface water antidegradation policies), and because it impedes the ability of inhabitants of the Camas Prairie to utilize a crucial natural resource: Most residents of the Camas Prairie rely upon the groundwater for their drinking water, as well as for other domestic and municipal uses. Groundwater contamination threatens these uses and threatens the health of Camas Prairie residents who draw water from local wells.

The contamination of the groundwater should have significant ramifications for management of the surface waters in the subbasin. This is because, as is recognized in the assessment, there is (1) considerable interaction between surface and groundwater in the subbasin, and (2) a number of the subbasins surface waters contain elevated levels of nitrogen. Consequently, it appears likely that the high levels of nitrogen in the surface waters are contributing to the contamination of the groundwater. This is inconsistent with Idaho's Ground Water Quality Rule (IDAPA 58.01.11) which states, in part, that "the implementation of water quality programs shall ensure that surface water infiltration does not impair beneficial uses of ground water."

Additionally, because of the high degree of surface-groundwater interaction in the subbasin, elevated nitrogen levels in one surface water body are likely impacting other surface water bodies in the subbasin and causing degradation of waters in violation of water quality laws. Surface waters with elevated nitrogen levels can mix with the groundwater which, in turn, can contribute to flows in other surface waters. As a result, waters with low nitrogen content can be degraded with flows from other, high-nitrogen waters in the subbasin. Again this can cause violations of the state's antidegradation policies.

Nitrogen inputs into the surface waters must be controlled to protect the ecological integrity of those waters from degradation by nitrogen, but also to prevent further degradation of the groundwater. The Department should use the TMDL process to guarantee that there are adequate controls regarding the amount of nitrogen flowing into surface waters from point and nonpoint sources of pollution.

The Camas Prairie referred to in the 2002 nitrate study refers to the Camas Prairie located in northern Idaho in Idaho County.

PCP #7. The department should more fully describe the authorities relied upon in its assessment and TMDL development, and its reasons for selecting those authorities.

A). The mandate by both state and federal lawmakers for agencies to provide to the public a meaningful opportunity for comment on critical decisions they make demonstrates the importance of the public's role in helping shape these decisions and their outcomes. In order for the public comment process to be efficient and useful, however, there must be an adequate flow of information between both the agencies responsible for formulating the rules, and the public seeking to comment on those rules.

In addition to the public comment period, public meetings in the form of the Watershed Advisory Group meetings were held once a month. At these meetings the subbasin assessment and TMDL was discussed along with other water quality issues. Meetings were advertised in the newspaper frequently and were posted on the DEQ calendar. The public's ability to comment on decisions made in the document or to question aspects of the document incorporated the three years of development.

The assessment should include a description of the sources relied upon in the assessment, and the reasons why those sources were chosen as authorities. The Coalition, for example, would like to know why the assessment uses water quality criteria established by the EPA in some portions of the document, but uses other authorities, such as the European Inland Fisheries Advisory Commission, in other portions of the assessment. Similarly, the assessment should explain why targets used in establishing TMDLs in other areas of Idaho are (1) valid and (2) appropriate to use in establishing targets for this particular subbasin. The absence of such elaboration on the sources and authorities behind the assessment effectively prevents the public from providing meaningful comment on the methodology used and the conclusions reached in assessment.

The goal of a TMDL is to restore the beneficial uses of the water body to full support status, in doing so targets were developed. It may be found that targets were not sufficient to restore beneficial uses for a given water body. Further monitoring in the future will help us identify if sufficient BMPs are being completed to restore the beneficial uses. Future monitoring may also indicate that targets and load allocations for certain pollutants will need to be adjusted to restore beneficial uses. The TMDL is not the end of the monitoring and evaluation of pollutants within the subbasin and water bodies. Further monitoring when possible will aid in determining the progress that is occurring and the steps that need to be taken.

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USFS #1. Tables 1 and 14 provide the boundaries of the 1998 303(d) stream segments and Tables 3 and 102, among other things, mention recommended changes to the list, but the latter two lists (and the text as far as I could tell) don't say anything about the boundaries on the segments. Can it be assumed that the boundaries will stay the same? I suggest that the document show what changes in 303(d) boundaries are proposed or explicitly state that there are no proposed changes in the 303 (d) section boundaries.

The stream segments for impairment will remain the same; however the TMDL still incorporates the entire length of the stream. This statement will be placed as a footnote in the above mentioned tables.

USFS #2. In Section 2.3, assessments are provided for water quality characteristics of the various streams in the subbasin and stream sections are often referred to as "upper," "middle," "lower," etc. As far as I could see though, these reach descriptions are not specified anywhere in the document. I suggest that narrative descriptions of the stream reach boundaries or a map showing the same be provided.

Reach descriptions in the tables and descriptions referring to biological data collection often refer to general representative descriptions of lower reaches, middle reaches, and upper reaches of the creek. Stream bank stability reaches are identified with GPS coordinates and a rough map of the segments in Appendix 4, however verbal descriptions will be added to the GPS coordinates table. Verbal descriptions of canopy cover reaches will be added to Appendix 5.

<u>USFS#3.</u> In Section 2.3, the potential irrigation diversion volumes (most showing startling over appropriation) for the various streams and tributaries are shown at the end of the "Hydrology" section for each stream but, while other causes are discussed for low flows, intermittent reaches, or water temperature increases, these diversions are not mentioned (as far as I could see). Table 103 at the end of the Section 5 notes whether flow alteration are judged to have impacts to water quality for specific stream reaches, this table is far away from the technical discussions in Section 2.3 and doesn't provide any details. A complete report would have a full discussion of the effects of irrigation diversions on water quality.

The following statement has been added to the discussions of events that may be contributing to elevated temperatures: Removal of water for water use demands reduces the quantity of water and allows solar radiation to elevate temperatures more rapidly.

<u>USFS #4.</u> On page 63, it is stated in the text that brook trout have been found to occur in Willow Creek and references Table 24. The table does not show the presence of brook trout at any of the sampling sites, and this absence comports with my personal knowledge. I believe that the text should be modified.

The correction has been made.

<u>USFS #5.</u> On page 72, mention is made of the 1st fire in the Beaver Creek drainage during 2001. Contrary to what the document states, I remember that a portion of the Beaver Creek riparian zone near the Willow Creek road crossing was burned during this fire.

The previously written statement has been replaced with the following: In 2001 two range fires burned through or near the Beaver Creek drainage. These fires greatly impacted Beaver Creek and destroyed most of the riparian zone in the lower half of the creek.

<u>USFS #6.</u> On page 98, a mention of the origins of Elk Creek on USFS-managed land is omitted.

This has been added to the document.

<u>USFS #7.</u> On page 115, the gradient of the 303(d) section of Corral Creek is states as 7.52%, which seems unlikely.

The gradient of 7.52% refers to the 303(d) listed segment of Cow Creek rather than Corral Creek.

<u>EPA #1.</u> I would like to recommend that you use the Ecoregional Criteria for Nutrients that was published in the federal register in January 2003. It seems that it would be more applicable to addressing this issue than the 1986 Gold Book standard.

Reasons for not using the Ecoregional Criteria were given in the section entitled Analysis Process.

EPA #2. Page 36. In the last paragraph which discussed the results of a WBAG study. It concludes that no fish data was collected in Elk Creek or Cow Creek. It is therefore assumed that salmonid spawning does not occur. I would take the more conservative approach and assume that it does occur until data indicates otherwise. If there are other circumstances that would lead you to this conclusion from field observation than please add that.

A further explanation of the SS spawning criteria has been added to the document…"and there has been no fish data collected on Elk Creek or Cow Creek. As a result, salmonid spawning is not identified as an existing use at this time. It is unlikely that SS is occurring in Cow Creek as the 303(d) listed portion is a short first order segment and the remaining portions of Cow Creek are intermittent and has water during spring runoff. Elk Creek similarly has few tributaries and is intermittent. The water body in the Elk Creek drainage that provides limited perennial waters in the upper end of Elk Creek is a geothermically warm water body fed by hot springs. Salmonid spawning is likely not to occur in these watersheds due to the lack of water or warm water influence. The SS criteria will not be assessed, but may need to be readdressed at a later date when data gaps are filled."

EPA #3. Page 190. The target for bacteria is identified as the 576 col/100 ml of E. coli organisms, instead of the geometric mean of 126 col/100ml. In our comments on the Goose and Raft TMDLs we asked that the average value be the target to meet Idaho's water quality standard. To be consistent with the changes that were made in that document, please revise this section accordingly.

The document in the subheading Targets now reads as follows in "As a result 576 colonies of E. coli organisms will be the target for the bacteria TMDL on Wild Horse Creek. However, the geometric mean value of 126 cfu/100 ml will be the value used to determine compliance with the standards."